banded with crescents of pigment (as in the *Trigla lineata* of authors), which likewise forms striking touches here and there on its body. The three free filaments of the pectorals are united by a membrane nearly to the tip, and are used by the fish when creeping on the bottom. The condition of the very young haddock, skulpin, frogfish, ling, rockling, and young flatfishes of various kinds in August (and of this season), all bear out the opinion above expressed, viz. that the young cod which appear off our rocks (and ranging in length from $1\frac{1}{8}$ to $1\frac{3}{4}$ inch in the beginning of June) are not the product of the eggs which abound near the surface of the sea chiefly in April.

In reference to Prof. Sars's remark about the association of the young fishes with Medusæ, I may observe that this association in the earlier stages with the Ctenophora is followed by different results, for occasionally, on examining the contents of the large midwater-net, many *Pleurobranchiæ* have young fishes in their stomachs. These young fishes, it is true, are either dead or sickly; but *Pleurobrachia* is capable of engulfing somewhat active forms, such as Zoeæ. Whether the products of the reproductive organs of the Medusæ are utilized by the larval fishes is still an open question. Their enormous numbers in the sea around them, at all events, is a striking feature. Hydroids, such as *Obelia geniculata*, are greedily eaten by young green cod, and the stomachs of the adult common cod contain diverse Cœlenterates.

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## XXXI.—*Histological Investigations upon the Nervous System of the Chætopoda.* By Dr. Emil Rohde *.

Histological investigations upon the nervous system of *Polynoë elegans* had shown me that the so-called neural canals in the Polychæta were colossal nerve-fibres, the detailed study of which promised important data as to the structure of the nervous system in animals generally. By the munificence of the Berlin Academy of Sciences I was last year enabled to work for several months in the Zoological Station at Naples, and to collect from the Polychæta occurring in the Bay abundant materials for the further prosecution of this

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inquiry. I may be permitted here to express to the Academy my thanks for its kind assistance.

In what follows I give in outline the results I obtained with regard to the nervous system in the family of the Aphroditeæ, of which I have studied, in accordance with the newest methods of investigation, the genera *Aphrodite*, *Hermione*, *Sthenelais*, *Sigalion*, *and Polynoë*. I will not here enter upon a discussion and criticism of the literature of the subject, but will refer the reader to a larger memoir upon the same subject which will very shortly appear.

For the understanding of the colossal nerve-fibres it is necessary to preface a word or two upon the so-called Leydigian dotted substance (*Punktsubstanz*). If the brain of the Polychæta be examined in thin sections, it is seen to consist of very numerous fine fibrils, which are confusedly intermixed and appear sometimes as lines in longitudinal sections, sometimes as points in transverse sections. The ventral cord has essentially the same structure, only in this longitudinal fibrils predominate, which, however, are crossed by oblique and transverse ones. In contradistinction to the brain, transverse and longitudinal sections in the ventral cord show a different picture—the longitudinal sections more lines, the transverse sections more dots. The nerves emitted are exactly of the same structure as the ventral cord, only in them the longitudinal course of the fibrils appears still more clearly, although even here straight and oblique ones are not excluded. The ventral cord, therefore, is not a central organ of peculiar structure, but only a somewhat more strongly-developed nerve which is beset with ganglion-cells. Even in those Aphroditeæ in which the ganglion-cells do not form a uniform coat of the ventral cord, but at definite distances apart constitute so-called ganglion-nodes, as in *Hermione* and *Aphrodite*, these ganglion-nodes are only distinguished histologically from the commissures lying between them and the emitted nerves by the processes of the ganglion-cells which traverse the central fibrils transversely. Anastomoses between the individual fibrils, by which a union of the ganglion-cells would be established, I have been unable to observe, any more than a breaking up of the fibrils into granules.

In this mass of fine fibrils the colossal nerve-fibres appear distinctly. They are the processes of colossal ganglion-cells, which occur in the brain and ventral cord in definite relative positions. The genus *Sthenelais* is a very favourable object for the study of the colossal nerve-fibres, as in it they are particularly numerous and highly developed. In *Sthenelais* there are three kinds of them, namely:—1, traversing the

whole nervous system from front to back; 2, running from behind forwards; and 3, starting in each segment on each side from the nervous system and running to the periphery.

If we trace the nervous system of *Sthenelais* in cross sections from before backwards we find even in the posterior part of the brain a colossal ganglion-cell on each side, which sends its large process first of all forward for some distance into the brain, and then through the œsophageal commissures into the ventral cord. Here the two nerve-fibres, after a short course, unite into a single one, which runs ventrally on one side of the ventral cord to the posterior extremity of the body. This colossal nerve-fibre is enveloped by a fibrous sheath, which is at first closely applied to it, but in its further course separates from it and then encloses a cavity, which constantly becomes larger posteriorly and in the middle of the body attains an enormous diameter. In this region also the nerve-fibre, which almost disappears in its wide sheath, becomes essentially modified; it shows everywhere on its surface denticulations of different sizes, which frequently pass into fine processes, traversing the whole cavity and apparently penetrating into the sheath. Towards the posterior extremity of the body the cavity becomes smaller, until the nerve-fibre again almost completely fills the sheath, and thus conditions corresponding to those of the anterior extremity are re-established.

At the commencement of the ventral cord on each side there are associated with this colossal nerve-fibre five others of exactly the same structure. Soon after the union of the œsophageal commissures with the ventral cord there are on each side two colossal ganglion-cells placed ventrally, the processes of which penetrate into the nervous system and pass over to the other side to run backward, closely applied to the median partition-wall which here divides the ventral cord into two. Almost at the same time two lateral colossal ganglion-cells on each side send their nervous processes transversely through the ventral cord towards the opposite side, where they run almost exactly in the middle to the end of the body. Close behind these ganglion-cells a fifth finally occurs on each side, the process of which does not pass to the opposite side, but bends in the longitudinal direction immediately after its entrance into the ventral cord.

But, as already indicated, colossal nerve-fibres traverse the whole ventral cord, running not only from before backwards, but also in the opposite direction.

Thus at the commencement of every body-segment, except only about the anterior sixteen, there is placed laterally, but

always only upon one side of the segment—to the left in one, to the right in another, but without any definite order—a colossal ganglion-cell, the strong process of which passes to the opposite side, but returns to its original side after a short course, here quitting the nervous system dorsally and running forward applied against the dorsal surface of the ventral cord. The first of these lateral ganglion-cells occurs in the ante-penultimate body-segment. In about fourteen of the following segments anteriorly the number of the dorsally-placed colossal nerve-fibres constantly increases by the ganglion-cell processes which join them in the individual segments, until six or seven of these nerve-fibres run on each side. This number does not increase further, although in each segment a colossal ganglion-cell contributes its process. I have been unable to ascertain with certainty whether in the middle segments of the body on the accession of a new nerve-fibre some of the old ones unite together or come to an end. Sometimes one sees some neighbouring nerve-spaces run together; but I have not observed any union of the true nerve-fibres situated in them. On the other hand, I several times saw some of the dorsal nerve-fibres quit their places and enter into the nervous system, where, after a time, they disappeared.

Besides the lateral ganglion-cells just described there is on each side, in the middle of each segment, a ventral colossal ganglion-cell the process of which traverses the ventral cord, issuing from it on the other side, and running in the subcuticula towards the surface of the body. In these colossal nerve-fibres running peripherally there is no development of a cavity within the sheath.

By means of transverse sections I have been able to trace out the mode of termination of the colossal fibres in those running from before backwards. In the last segments the sheath becomes gradually thinner, and the nerve-fibres, which are closely embraced by it, more and more distinctly granulated. Finally the sheath ceases entirely. After a short course the nerve-fibre also disappears without becoming perceptibly thinner. In its place in the cross section we see fine points with no definite arrangement. The colossal nerve-fibre has consequently broken up into fine fibrils.

In *Sigalion* there are only colossal nerve-fibres running from before backward, and, indeed, in each half of the ventral cord a median one and a ventral one, of which the former is the process of a ganglion-cell situated in the initial portion of the ventral cord; while the ventral fibre, in accordance with the conditions in *Sthenelais*, owes its origin to a ganglion-cell occurring at the end of the brain.

In *Polynoë* two median nerve-fibres and one ventral on each side traverse the ventral cord from before backward. The first two distinctly unite with ganglion-cells in the beginning of the ventral cord; in the case of the ventral fibre, which appears even in the œsophageal commissures, I have not succeeded in ascertaining the ganglion-cell belonging to it.

In agreement with *Sthenelais* there is, moreover, in *Polynoë* in each segment on each side an enormously large ganglion-cell, which sends its colossal nervous process transversely through the ventral cord into the last of the three nerves starting in each segment, in common with which it runs to the periphery.

In *Aphrodite* and *Hermione* colossal nerve-fibres of such construction are entirely wanting.

In conclusion, I will say a few words as to the structure of the ganglion-cells and their relation to the central fibrillar mass of the nervous system.

The ganglion-cells of the Aphroditeæ are without exception unipolar. In the rest of their structure, however, they show an extraordinary variety. Two opposite types especially occur among them. The ganglion-cells of one kind are very faintly granulated and therefore of clear appearance, and generally rather small. Their nucleus always contains several corpuscles of different sizes, and, when stained, is exceedingly prominent in the transparent ganglion-cell. They have a pyriform shape and lie, in large packets, close together. The representatives of the second type are very large spherical structures, which immediately catch the eye by their very dark granulation. They possess a large finely-granulated nucleus, and this a single large corpuscle. They are always single, never united into groups. To this type also belong the colossal ganglion-cells. Both kinds of ganglion-cells are destitute of a cell-membrane and lie imbedded in a network of fibres, which everywhere accompany the nervous system and, I believe, originate from subcuticular cells. But while this envelope of subcuticular fibres is very slight in the ganglion-cells of the first type, appearing rather as a thin partition between the closely appressed cells, in the second type, and especially in the colossal ganglion-cells, it is highly developed.

The processes of the transparent ganglion-cells of the first type run in bundles and interlaced with each other into the nervous system, accompanied by subcuticular fibres, which, however, disappear soon after their entrance. These cell-processes, which are generally very delicate, gradually become

thinner and pass over directly into the central fibrils. The processes of the ganglion-cells of the second type are broad dark fibres, upon which the sheath extends its cells for a long distance. They can therefore be easily traced in the nervous system among the fine fibrils, especially as their breadth does not diminish. After running some distance they lose their sheath and soon afterwards disappear in the mass of fine fibrils. It seems to me most probable that, like the colossal nerve-fibres, which they greatly resemble, they pass into the fibrillar substance by brush-like division, as I could never observe any binary division.

If we examine the ganglion-cells of the second type, and especially the colossal ones, we find that the whole cell is traversed in all directions by fibrils of different strengths, which pass over into the cell-process and give it a fine longitudinal striation. But these fibrils do not quit the cells only in this way; one is astonished to see how they issue everywhere at the periphery of the naked cell-body, singly or united into bundles, and penetrate into the subcuticular envelope. This observation may be made uniformly in preparations hardened in alcohol or in corrosive sublimate or osmic acid. Whether the ganglion-cells are united to one another by means of these fibrils I have been unable to decide, as they were not to be traced beyond the envelope of subcuticular fibres.

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## XXXII.—*An Entomogenous Fungus.*

By William Fawcett, B.Sc., F.L.S.

Dr. Günther has received from Mr. C. A. Lloyd, George Town, Demerara, a remarkable fungus growing on an ant (*Camponotus atriceps*). Mr. Lloyd found it on the banks of the river Puruni, in British Guiana, and though he has collected numerous specimens of different species of ants, he has not hitherto met with a similar growth. It is not so usual to find them on a perfect insect as on larvæ. Of the 47 species noted by Saccardo *, 23 (or about 50 per cent.) are found on larvæ, and only 16 (or about 33 per cent.) on perfect insects. Of these 16 species Saccardo only mentions 3 as having been found on ants—*Cordyceps unilateralis* on *Atta cephalota* in Brazil, *C. australis* on *Pachycondyla striata* in Brazil, and *C. myrmecophila* on *Myrmica rufa* (also rarely on an ichneu-

* 'Sylloge Fungorum,' vol. ii.